SEQUENCE LISTING

<110> MacKinnon, Roderick
        The Rockefeller University

<120> Assays for Screening Compounds Which Interact With
    .   Cation Channel Proteins, Mutant Prokaryotic Cation
        Channel Proteins, and Uses Thereof

<130> 018512-002901US

<140> US 09/275,252
<141> 1999-03-24

<150> US 09/045,529
<151> 1998-03-20

<150> US 09/054,347
<151> 1998-04-02 .

<150> WO PCT/US99/06307
<151> 1999-03-22

<160> 42

<170> PatentIn Ver. 2.1

<210> 1
<211> 160
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<213> Streptomyces lividans

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Met Pro Pro Met Leu Ser Gly Leu Leu Ala Arg Leu Val Lys Leu Leu
  1   5   10   15

Leu Gly Arg His Gly Ser Ala Leu His Trp Arg Ala Ala Gly Ala Ala
             20   25   30

Thr Val Leu Leu Val Ile Val Leu Leu Ala Gly Ser Tyr Leu Ala Val
         35   .   40   45

Leu Ala Glu Arg Gly Ala Pro Gly Ala Gln Leu Ile Thr Tyr Pro Arg
     50   55   60

Ala Leu Trp Trp Ser Val Glu Thr Ala Thr Thr Val Gly Tyr Gly Asp
 65   70   75   80

Leu Tyr Pro Val Thr Leu Trp Gly Arg Leu Val Ala Val Val Val Met
                 85   90   95

Val Ala Gly Ile Thr Ser Phe Gly Leu Val Thr Ala Ala Leu Ala Thr
             100   105   110

Trp Phe Val Gly Arg Glu Gln Glu Arg Arg Gly His Phe Val Arg His
             115   120   125

Ser Glu Lys Ala Ala Glu Glu Ala Tyr Thr Arg Thr Thr Arg Ala Leu
     130   135   140

His Glu Arg Phe Asp Arg Leu Glu Arg Met Leu Asp Asp Asn Arg Arg
145   150   155   160

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<213> Escherichia coli

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Met Ser His Trp Thr Thr Phe Lys Gln Thr Ala Thr Lys Leu Trp Val
  1   5   10   15

Thr Leu Arg His Asp Ile Leu Ala Leu Ala Val Phe Leu Asn Gly Leu
            20   25   30

Leu Ile Phe Lys Thr Ile Tyr Gly Met Ser Val Asn Leu Leu Asp Ile
        35   40   45

Phe His Ile Lys Ala Phe Ser Glu Leu Asp Leu Ser Leu Leu Ala Asn
    50   55   60

Ala Pro Leu Phe Met Leu Gly Val Phe Leu Val Leu Asn Ser Ile Gly
 65   70   75   80

Leu Leu Phe Arg Ala Lys Leu Ala Trp Ala Ile Ser Ile Ile Leu Leu
            85   90   95

Leu Ile Ala Leu Ile Tyr Thr Leu His Phe Tyr Pro Trp Leu Lys Phe
            100   105   110

Ser Ile Gly Phe Cys Ile Phe Thr Leu Val Phe Leu Leu Ile Leu Arg
            115   120   125

Lys Asp Phe Ser His Ser Ser Ala Ala Ala Gly Thr Ile Phe Ala Phe
    130   135   140

Ile Ser Phe Thr Thr Leu Leu Phe Tyr Ser Thr Tyr Gly Ala Leu Tyr
145   150   155   160

Leu Ser Glu Gly Phe Asn Pro Arg Ile Glu Ser Leu Met Thr Ala Phe
            165   170   175

Tyr Phe Ser Ile Glu Thr Met Ser Thr Val Gly Tyr Gly Asp Ile Val
            180   185   190

Pro Val Ser Glu Ser Ala Arg Leu Phe Thr Ile Ser Val Ile Ile Ser
            195   200   205

Gly Ile Thr Val Phe Ala Thr Ser Met Thr Ser Ile Phe Gly Pro Leu
    210   215   220

Ile Arg Gly Gly Phe Asn Lys Leu Val Lys Gly Asn Asn His Thr Met
225   230   235   240

His Arg Lys Asp His Phe Ile Val Cys Gly His Ser Ile Leu Ala Ile
            245   250   255

Asn Thr Ile Leu Gln Leu Asn Gln Arg Gly Gln Asn Val Thr Val Ile
            260   265   270

```
Ser Asn Leu Pro Glu Asp Asp Ile Lys Gln Leu Glu Gln Arg Leu Gly
        275             280             285

Asp Asn Ala Asp Val Ile Pro Gly Asp Ser Asn Asp Ser Ser Val Leu
        290             295             300

Lys Lys Ala Gly Ile Asp Arg Cys Arg Ala Ile Leu Ala Leu Ser Asp
305             310             315             320

Asn Asp Ala Asp Asn Ala Phe Val Val Leu Ser Ala Lys Asp Met Ser
            325             330             335

Ser Asp Val Lys Thr Val Leu Ala Val Ser Asp Ser Lys Asn Leu Asn
        340             345             350

Lys Ile Lys Met Val His Pro Asp Ile Ile Leu Ser Pro Gln Leu Phe
        355             360             365

Gly Ser Glu Ile Leu Ala Arg Val Leu Asn Gly Glu Glu Ile Asn Asn
        370             375             380

Asp Met Leu Val Ser Met Leu Leu Asn Ser Gly His Gly Ile Phe Ser
385             390             395             400

Asp Asn Asp Glu Gln Glu Thr Lys Ala Asp Ser Lys Glu Ser Ala Gln
            405             410             415

Lys
```

```
<210> 3
<211> 58
<212> PRT
<213> Clostridium acetobutylicum

<400> 3
Ser Leu Gly Asn Ala Leu Trp Trp Ser Phe Val Thr Ile Thr Thr Val
    1           5               10              15

Gly Tyr Gly Asp Ile Ser Pro Ser Thr Pro Phe Gly Arg Val Ile Ala
            20              25              30

Ser Ile Leu Met Leu Ile Gly Ile Gly Phe Leu Ser Met Leu Thr Gly
        35              40              45

Thr Ile Ser Thr Phe Phe Ile Ser Lys Lys
        50              55
```

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<210> 4
<211> 616
<212> PRT
<213> Drosophila melanogaster

<400> 4
Met Ala Ala Val Ala Gly Leu Tyr Gly Leu Gly Glu Asp Arg Gln His
    1           5               10              15

Arg Lys Lys Gln Gln Gln Gln Gln Gln His Gln Lys Glu Gln Leu Glu
            20              25              30
```

Gln Lys Glu Glu Gln Lys Lys Ile Ala Glu Arg Lys Leu Gln Leu Arg
        35   40   45

Glu Gln Gln Leu Gln Arg Asn Ser Leu Asp Gly Tyr Gly Ser Leu Pro
        50   55   60

Lys Leu Ser Ser Gln Asp Glu Glu Gly Gly Ala Gly His Gly Phe Gly
65   70   75   80

Gly Gly Pro Gln His Phe Glu Pro Ile Pro His Asp His Asp Phe Cys
            85   90   95

Glu Arg Val Val Ile Asn Val Ser Gly Leu Arg Phe Glu Thr Gln Leu
            100   105   110

Arg Thr Leu Asn Gln Phe Pro Asp Thr Leu Leu Gly Asp Pro Ala Arg
        115   120   125

Arg Leu Arg Tyr Phe Asp Pro Leu Arg Asn Glu Tyr Phe Phe Asp Arg
        130   135   140

Ser Arg Pro Ser Phe Asp Ala Ile Leu Tyr Tyr Tyr Gln Ser Gly Gly
145   150   155   160

Arg Leu Arg Arg Pro Val Asn Val Pro Leu Asp Val Phe Ser Glu Glu
        165   170   175

Ile Lys Phe Tyr Glu Leu Gly Asp Gln Ala Ile Asn Lys Phe Arg Glu
        180   185   190

Asp Glu Gly Phe Ile Lys Glu Glu Glu Arg Pro Leu Pro Asp Asn Glu
        195   200   205

Lys Gln Arg Lys Val Trp Leu Leu Phe Glu Tyr Pro Glu Ser Ser Gln
210   215   220

Ala Ala Arg Val Val Ala Ile Ile Ser Val Phe Val Ile Leu Leu Ser
225   230   235   240

Ile Val Ile Phe Cys Leu Glu Thr Leu Pro Glu Phe Lys His Tyr Lys
            245   250   255

Val Phe Asn Thr Thr Thr Asn Gly Thr Lys Ile Glu Glu Asp Glu Val
        260   265   270

Pro Asp Ile Thr Asp Pro Phe Phe Leu Ile Glu Thr Leu Cys Ile Ile
        275   280   285

Trp Phe Thr Phe Glu Leu Thr Val Arg Phe Leu Ala Cys Pro Asn Lys
    290   295   300

Leu Asn Phe Cys Arg Asp Val Met Asn Val Ile Asp Ile Ile Ala Ile
305   310   315   320

Ile Pro Tyr Phe Ile Thr Leu Ala Thr Val Val Ala Glu Glu Glu Asp
            325   330   335

Thr Leu Asn Leu Pro Lys Ala Pro Val Ser Pro Gln Asp Lys Ser Ser
        340   345   350

```
Asn Gln Ala Met Ser Leu Ala Ile Leu Arg Val Ile Arg Leu Val Arg
        355             360             365

Val Phe Arg Ile Phe Lys Leu Ser Arg His Ser Lys Gly Leu Gln Ile
        370             375             380

Leu Gly Arg Thr Leu Lys Ala Ser Met Arg Glu Leu Gly Leu Leu Ile
385             390             395             400

Phe Phe Leu Phe Ile Gly Val Val Leu Phe Ser Ser Ala Val Tyr Phe
                405             410             415

Ala Glu Ala Gly Ser Glu Asn Ser Phe Phe Lys Ser Ile Pro Asp Ala
        420             425             430

Phe Trp Trp Ala Val Val Thr Met Thr Thr Val Gly Tyr Gly Asp Met
        435             440             445

Thr Pro Val Gly Phe Trp Gly Lys Ile Val Gly Ser Leu Cys Val Ile
        450             455             460

Ala Gly Val Leu Thr Ile Ala Leu Pro Val Pro Val Ile Val Ser Asn
465             470             475             480

Phe Asn Tyr Phe Tyr His Arg Glu Ala Asp Arg Glu Glu Met Gln Ser
                485             490             495

Gln Asn Phe Asn His Val Thr Ser Cys Ser Tyr Leu Pro Gly Ala Leu
        500             505             510

Gly Gln His Leu Lys Lys Ser Ser Leu Ser Glu Ser Ser Ser Asp Ile
        515             520             525

Met Asp Leu Asp Asp Gly Ile Asp Ala Thr Thr Pro Gly Leu Thr Asp
        530             535             540

His Thr Gly Arg His Met Val Pro Phe Leu Arg Thr Gln Gln Ser Phe
545             550             555             560

Glu Lys Gln Gln Leu Gln Leu Gln Leu Gln Gln Gln Ser Gln
        565             570             575

Ser Pro His Gly Gln Gln Met Thr Gln Gln Gln Leu Gly Gln Asn
        580             585             590

Gly Leu Arg Ser Thr Asn Ser Leu Gln Leu Arg His Asn Asn Ala Met
        595             600             605

Ala Val Ser Ile Glu Thr Asp Val
610             615
```

```
<210> 5
<211> 495
<212> PRT
<213> Homo sapiens

<400> 5
Met Thr Val Met Ser Gly Glu Asn Val Asp Glu Ala Ser Ala Ala Pro
  1           5             10              15
```

Gly His Pro Gln Asp Gly Ser Tyr Pro Arg Gln Ala Asp His Asp Asp
            20   25   30

His Glu Cys Cys Glu Arg Val Val Ile Asn Ile Ser Gly Leu Arg Phe
        35   40   45

Glu Thr Gln Leu Lys Thr Leu Ala Gln Phe Pro Asn Thr Leu Leu Gly
    50   55   60

Asn Pro Lys Lys Arg Met Arg Tyr Phe Asp Pro Leu Arg Asn Glu Tyr
65   70   75   80

Phe Phe Asp Arg Asn Arg Pro Ser Phe Asp Ala Ile Leu Tyr Tyr Tyr
            85   90   95

Gln Ser Gly Gly Arg Leu Arg Arg Pro Val Asn Val Pro Leu Asp Met
            100   105   110

Phe Ser Glu Glu Ile Lys Phe Tyr Glu Leu Gly Glu Glu Ala Met Glu
    115   120   125

Lys Phe Arg Glu Asp Glu Gly Phe Ile Lys Glu Glu Glu Arg Pro Leu
    130   135   140

Pro Glu Lys Glu Tyr Gln Arg Gln Val Trp Leu Leu Phe Glu Tyr Pro
145   150   155   160

Glu Ser Ser Gly Pro Ala Arg Val Ile Ala Ile Val Ser Val Met Val
            165   170   175

Ile Leu Ile Ser Ile Val Ile Phe Cys Leu Glu Thr Leu Pro Glu Leu
            180   185   190

Lys Asp Asp Lys Asp Phe Thr Gly Thr Val His Arg Ile Asp Asn Thr
            195   200   205

Thr Val Ile Tyr Asn Ser Asn Ile Phe Thr Asp Pro Phe Phe Ile Val
    210   215   220

Glu Thr Leu Cys Ile Ile Trp Phe Ser Phe Glu Leu Val Val Arg Phe
225   230   235   240

Phe Ala Cys Pro Ser Lys Thr Asp Phe Phe Lys Asn Ile Met Asn Phe
            245   250   255

Ile Asp Ile Val Ala Ile Ile Pro Tyr Phe Ile Thr Leu Gly Thr Glu
            260   265   270

Ile Ala Glu Gln Glu Gly Asn Gln Lys Gly Glu Gln Ala Thr Ser Leu
            275   280   285

Ala Ile Leu Arg Val Ile Arg Leu Val Arg Val Phe Arg Ile Phe Lys
    290   295   300

Leu Ser Arg His Ser Lys Gly Leu Gln Ile Leu Gly Gln Thr Leu Lys
305   310   315   320

Ala Ser Met Arg Glu Leu Gly Leu Leu Ile Phe Phe Leu Phe Ile Gly
            325   330   335

```
Val Ile Leu Phe Ser Ser Ala Val Tyr Phe Ala Glu Ala Glu Glu Ala
            340             345             350

Glu Ser His Phe Ser Ser Ile Pro Asp Ala Phe Trp Trp Ala Val Val
            355             360             365

Ser Met Thr Thr Val Gly Tyr Gly Asp Met Tyr Pro Val Thr Ile Gly
    370                 375             380

Gly Lys Ile Val Gly Ser Leu Cys Ala Ile Ala Gly Val Leu Thr Ile
385                 390             395             400

Ala Leu Pro Val Pro Val Ile Val Ser Asn Phe Asn Tyr Phe Tyr His
                405             410             415

Arg Glu Thr Glu Gly Glu Glu Gln Ala Gln Leu Leu His Val Ser Ser
            420             425             430

Pro Asn Leu Ala Ser Asp Ser Asp Leu Ser Arg Arg Ser Ser Ser Thr
            435             440             445

Met Ser Lys Tyr Glu Tyr Met Glu Ile Glu Glu Asp Met Asn Asn Ser
    450             455             460

Ile Ala His Tyr Arg Gln Val Asn Ile Arg Thr Ala Asn Cys Thr Thr
465             470             475             480

Ala Asn Gln Asn Cys Val Asn Lys Ser Lys Leu Leu Thr Asp Val
                485             490             495
```

<210> 6
<211> 858
<212> PRT
<213> Homo sapiens

<400> 6
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Met Pro Ala Gly Met Thr Lys His Gly Ser Arg Ser Thr Ser Ser Leu
  1           5                 10                  15

Pro Pro Glu Pro Met Glu Ile Val Arg Ser Lys Ala Cys Ser Arg Arg
            20                  25                  30

Val Arg Leu Asn Val Gly Gly Leu Ala His Glu Val Leu Trp Arg Thr
        35                  40                  45

Leu Asp Arg Leu Pro Arg Thr Arg Leu Gly Lys Leu Arg Asp Cys Asn
        50                  55                  60

Thr His Asp Ser Leu Leu Glu Val Cys Asp Asp Tyr Ser Leu Asp Asp
 65                  70                  75                  80

Asn Glu Tyr Phe Phe Asp Arg His Pro Gly Ala Phe Thr Ser Ile Leu
                85                  90                  95

Asn Phe Tyr Arg Thr Gly Arg Leu His Met Met Glu Glu Met Cys Ala
            100             105             110

Leu Ser Phe Ser Gln Glu Leu Asp Tyr Trp Gly Ile Asp Glu Ile Tyr
        115             120             125
```

```
Leu Glu Ser Cys Cys Gln Ala Arg Tyr His Gln Lys Lys Glu Gln Met
    130             135         140
```

```
Asn Glu Glu Leu Lys Arg Glu Ala Glu Thr Leu Arg Glu Arg Glu Gly
145             150             155             160
```

```
Glu Glu Phe Asp Asn Thr Cys Cys Ala Glu Lys Arg Lys Lys Leu Trp
            165         170             175
```

```
Asp Leu Leu Glu Lys Pro Asn Ser Ser Val Ala Ala Lys Ile Leu Ala
            180         185             190
```

```
Ile Ile Ser Ile Met Phe Ile Val Leu Ser Thr Ile Ala Leu Ser Leu
        195             200             205
```

```
Asn Thr Leu Pro Glu Leu Gln Ser Leu Asp Glu Phe Gly Gln Ser Thr
    210             215             220
```

```
Asp Asn Pro Gln Leu Ala His Val Glu Ala Val Cys Ile Ala Trp Phe
225             230             235             240
```

```
Thr Met Glu Tyr Leu Leu Arg Phe Leu Ser Ser Pro Lys Lys Trp Lys
            245             250             255
```

```
Phe Phe Lys Gly Pro Leu Asn Ala Ile Asp Leu Leu Ala Ile Leu Pro
            260             265             270
```

```
Tyr Tyr Val Thr Ile Phe Leu Thr Glu Ser Asn Lys Ser Val Leu Gln
            275             280             285
```

```
Phe Gln Asn Val Arg Arg Val Val Gln Ile Phe Arg Ile Met Arg Ile
    290             295             300
```

```
Leu Arg Ile Leu Lys Leu Ala Arg His Ser Thr Gly Leu Gln Ser Leu
305             310             315             320
```

```
Gly Phe Thr Leu Arg Arg Ser Tyr Asn Glu Leu Gly Leu Leu Ile Leu
            325             330             335
```

```
Phe Leu Ala Met Gly Ile Met Ile Phe Ser Ser Leu Val Phe Phe Ala
            340             345             350
```

```
Glu Lys Asp Glu Asp Asp Thr Lys Phe Lys Ser Ile Pro Ala Ser Phe
    355             360             365
```

```
Trp Trp Ala Thr Ile Thr Met Thr Thr Val Gly Tyr Gly Asp Ile Tyr
370             375             380
```

```
Pro Lys Thr Leu Leu Gly Lys Ile Val Gly Gly Leu Cys Cys Ile Ala
385             390             395             400
```

```
Gly Val Leu Val Ile Ala Leu Pro Ile Pro Ile Ile Val Asn Asn Phe
            405             410             415
```

```
Ser Glu Phe Tyr Lys Glu Gln Lys Arg Gln Glu Lys Ala Ile Lys Arg
            420             425             430
```

```
Arg Glu Ala Leu Glu Arg Ala Lys Arg Asn Gly Ser Ile Val Ser Met
    435             440             445
```

Asn Met Lys Asp Ala Phe Ala Arg Ser Ile Glu Met Met Asp Ile Val
    450   455   460

Val Glu Lys Asn Gly Glu Asn Met Gly Lys Lys Asp Lys Val Gln Asp
465   470   475   480

Asn His Leu Ser Pro Asn Lys Trp Lys Trp Thr Lys Arg Thr Leu Ser
          485   490   495

Glu Thr Ser Ser Ser Lys Ser Phe Glu Thr Lys Glu Gln Gly Ser Pro
        500   505   510

Glu Lys Ala Arg Ser Ser Ser Ser Pro Gln His Leu Asn Val Gln Gln
      515   520   525

Leu Glu Asp Met Tyr Asn Lys Met Ala Lys Thr Gln Ser Gln Pro Ile
    530   535   540

Leu Asn Thr Lys Glu Ser Ala Ala Gln Ser Lys Pro Lys Glu Glu Leu
545   550   555   560

Glu Met Glu Ser Ile Pro Ser Pro Val Ala Pro Leu Pro Thr Arg Thr
        565   570   575

Glu Gly Val Ile Asp Met Arg Ser Met Ser Ser Ile Asp Ser Phe Ile
      580   585   590

Ser Cys Ala Thr Asp Phe Pro Glu Ala Thr Arg Phe Ser His Ser Pro
      595   600   605

Leu Thr Ser Leu Pro Ser Lys Thr Gly Gly Ser Thr Ala Pro Glu Val
    610   615   620

Gly Trp Arg Gly Ala Leu Gly Ala Ser Gly Gly Arg Phe Val Glu Ala
625   630   635   640

Asn Pro Ser Pro Asp Ala Ser Gln His Ser Ser Phe Phe Ile Glu Ser
        645   650   655

Pro Lys Ser Ser Met Lys Thr Asn Asn Pro Leu Lys Leu Arg Ala Leu
        660   665   670

Lys Val Asn Phe Met Glu Gly Asp Pro Ser Pro Leu Leu Pro Val Leu
      675   680   685

Gly Met Tyr His Asp Pro Leu Arg Asn Arg Gly Ser Ala Ala Ala Ala
    690   695   700

Val Ala Gly Leu Glu Cys Ala Thr Leu Leu Asp Lys Ala Val Leu Ser
705   710   715   720

Pro Glu Ser Ser Ile Tyr Thr Thr Ala Ser Ala Lys Thr Pro Pro Arg
        725   730   735

Ser Pro Glu Lys His Thr Ala Ile Ala Phe Asn Phe Glu Ala Gly Val
        740   745   750

His Gln Tyr Ile Asp Ala Asp Thr Asp Asp Glu Gly Gln Leu Leu Tyr
        755   760   765

```
Ser Val Asp Ser Ser Pro Pro Lys Ser Leu Pro Gly Ser Thr Ser Pro
    770             775             780
```

```
Lys Phe Ser Thr Gly Thr Arg Ser Glu Lys Asn His Phe Glu Ser Ser
785             790             795                 800
```

```
Pro Leu Pro Thr Ser Pro Lys Phe Leu Arg Gln Asn Cys Ile Tyr Ser
            805             810                 815
```

```
Thr Glu Ala Leu Thr Gly Lys Gly Pro Ser Gly Gln Glu Lys Cys Lys
            820             825             830
```

```
Leu Glu Asn His Ile Ser Pro Asp Val Arg Val Leu Pro Gly Gly Gly
        835             840             845
```

```
Ala His Gly Ser Thr Arg Asp Gln Ser Ile
    850             855
```

```
<210> 7
<211> 597
<212> PRT
<213> Paramecium tetraurelia
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<400> 7
Met Gly Pro Lys Ile Arg Ala Ile Ser Phe Gln Ser Asn Lys Pro Met
  1             5               10                  15
```

```
Met Asn Leu Lys Glu Asp Ser Pro Val Phe Ile Asp Ser His Thr Asp
            20              25                  30
```

```
His Val Gly Phe Ser Asn Lys Ile Trp Arg Thr Lys Ala Leu Glu Ile
            35              40                  45
```

```
Leu Met Ile Thr Leu Arg Phe Ile Ser Phe Ile Thr Lys Ser Asn Phe
    50              55                  60
```

```
Ala Thr Ser Phe Lys Leu Ile Asn Lys Asn Val Phe Glu Ile Ile Gly
 65                 70              75                  80
```

```
Asp Val Ser Ala Asp Phe Thr Tyr Tyr Leu Leu Lys Asn Phe Phe Lys
                85              90                  95
```

```
Tyr Glu Lys Pro Thr Gly Phe Gln Lys Gly Gln His Phe Leu Asn Gln
            100             105             110
```

```
Thr Leu Leu Ile Pro Leu Arg Lys Thr Lys Leu Leu Lys Ile Tyr Cys
        115             120             125
```

```
Gly Asn Gln Lys Leu Ile Met Arg Pro Glu Ser Leu Ala Ser Ile Trp
    130             135             140
```

```
Trp Asn Ile Tyr Ile Leu Thr Ile Leu Asn Ile Asn Val Leu Tyr Val
145             150             155             160
```

```
Ser Ile Lys Ile Ala Phe Lys Phe Asp Glu Gln Ser Gln Asp Asp Phe
            165             170             175
```

```
Tyr Gln Ala Arg Gln Ile Ile Phe Asp Val Leu Pro Ser Tyr Ser Phe
            180             185             190
```

```
Met Leu Glu Ile Leu Leu Lys Phe Asn Thr Cys Tyr Tyr Tyr Lys Gly
        195                 200             205

Ala Val Ile Glu Asn Arg Tyr Gln Ile Ala Lys Asn Tyr Leu Arg Ser
        210                 215             220

Ser Phe Phe Phe Asp Ile Phe Val Val Ile Pro Tyr Phe Ile Ser Leu
225                 230                 235                 240

Arg Phe Asp Leu Gln Tyr Leu Asp Leu Val Ile Ile Leu Lys Val Phe
                245                 250                 255

Gln Ile Thr Lys Phe Ser Arg Asn Leu Phe Asp Arg Leu Glu Leu Thr
                260                 265                 270

Ala Ile Gln Ile Val Ile Val Asp Leu Val Lys Leu Gly Tyr Thr Ile
                275                 280                 285

Leu Ala Ala Ala His Phe Ser Ala Cys Ile Trp Phe Leu Val Gly Ser
        290                 295                 300

Thr Gly Asn Pro Asn Asp Thr Ser Trp Ile Lys Ala Gln Asn Ile Glu
305                 310                 315                 320

Asn Glu Gln Trp Phe Asn Gln Tyr Leu His Ser Leu Tyr Trp Ser Ile
                325                 330                 335

Ile Thr Met Thr Thr Ile Gly Tyr Gly Asp Ile Thr Pro Gln Asn Leu
                340                 345                 350

Arg Glu Arg Val Phe Ala Val Gly Met Ala Leu Ser Ala Val Gly Val
                355                 360                 365

Phe Gly Tyr Ser Ile Gly Asn Ile Asn Ser Ile Tyr Ala Glu Trp Ser
        370                 375                 380

Arg Gln Ser Phe Gln Ile Arg Thr Asp Met Asn Asn Leu Lys Lys Phe
385                 390                 395                 400

Ile Arg Ile Lys Gly Ile Asn Lys His Leu Ala Glu Lys Ile Arg Lys
                405                 410                 415

Tyr Phe Glu Tyr Val Trp Ser Asp Gln Met Glu Asp Asn Asp Arg Glu
                420                 425                 430

Val Tyr Lys Phe Ser Glu Met Ile Pro Lys Gln Leu Ala Glu Glu Met
                435                 440                 445

Lys Ile Asp Thr Asn Met Lys Leu Ile Gln Lys Asn Ser Phe Leu Val
        450                 455                 460

Asn Asn Phe Ser Glu Gln Phe Leu Ile Ser Leu Ser Lys Val Leu Ile
465                 470                 475                 480

Glu Glu Lys Tyr Val Pro Glu Ser Thr Ile Tyr Leu Val Lys Leu Ile
                485                 490                 495

Asn Ile Leu Gln Gln Asn Asp Pro Ser Asn Tyr Leu Tyr Ile Leu Ser
                500                 505                 510
```

Asn Gly Ser Leu Ser Phe Tyr Ile Thr Leu Asn Asn Lys Gln Gln Thr
        515   520   525

Ile Lys Val Leu Glu Thr Ile Lys Asn Glu Gly Gln Ala Phe Gly Val
    530   535   540

Leu Glu Phe Phe Gln Ser Gln Ala Tyr Gln Val Ser Cys Lys Ser Asn
545   550   555   560

Gln Phe Ser Tyr Val Leu Lys Ile Asp Lys Ser Gln Phe Met Glu Ile
            565   570   575

Ile Ser Gln His Lys Asn Asp Tyr Val Thr Gln Ile Ile Tyr Leu Ile
        580   585   590

Leu Val Gln Ile Leu
        595

<210> 8
<211> 556
<212> PRT
<213> Caenorhabditis elegans

<400> 8
Asp Ala Cys Ser Phe Asn Arg Phe Asp Ser Asn Arg Ser Ser Ala Arg
 1   5   10   15

Arg Phe Ser Arg Arg Gly Ser Asp Tyr Phe Gly Asp Lys Gly Ile Ser
            20   25   30

Met Asp Glu Arg Ile Val Leu Asn Val Gly Gly Val Arg His Glu Thr
        35   40   45

Tyr Gln Ala Thr Leu Lys Lys Ile Pro Ala Thr Arg Leu Ser Arg Leu
    50   55   60

Thr Pro Ser Leu Ala Asn Phe Asp Pro Leu Leu Asn Glu Tyr Phe Phe
65   70   75   80

Asp Arg His Pro Ala Val Phe Ala Met Ile Leu Asn Tyr Tyr Arg Thr
            85   90   95

Gly Lys Leu His Tyr Pro Thr Asp Val Cys Gly Pro Leu Phe Glu Glu
            100   105   110

Glu Leu Gln Tyr Trp Gly Leu Asp Ala Ser Asp Thr Glu Pro Cys Cys
        115   120   125

Trp Met Gln Leu Leu His Ala Lys Asp Thr Gln Glu Thr Leu Ala Val
    130   135   140

Leu Asp Arg Met Asp Ala Asp His Glu Asp Asp Pro Gln Leu Arg Glu
145   150   155   160

Gln Asp Thr Met Lys Lys Phe Gly Trp Glu Glu Asp Tyr Phe Gln Gly
            165   170   175

Lys Arg Thr Arg Trp Met Lys Leu Lys Pro Gln Met Trp Ser Leu Phe
            180   185   190

```
Asp Glu Pro Tyr Ser Ser Gln Ala Ala Lys Leu Ile Ala Gly Ile Ser
        195                 200             205

Val Leu Phe Ile Phe Ile Ser Ile Phe Ser Phe Cys Leu Lys Thr His
        210                 215             220

Gln Ser Phe Arg Leu Pro Val Leu Ile Gly Gln Asn Ile Thr Met Pro
225                 230             235                 240

Gly Gly Val Val Gln Pro Ser Ile Glu Arg Val Ser Thr Glu Pro Leu
                245             250                 255

Pro Ile Phe Gly Gln Ile Glu Met Leu Cys Asn Ile Trp Phe Thr Leu
            260             265             270

Glu Leu Ile Ile Arg Phe Val Phe Cys Pro Ser Lys Ile Arg Phe Phe
            275             280             285

Lys Ser Pro Leu Asn Met Ile Asp Leu Val Ala Thr Leu Ser Phe Tyr
    290             295             300

Ala Asp Ala Met Met Val Arg Val Val Glu Asp Glu Pro Lys Asp Val
305             310             315                 320

Val Glu Phe Leu Ser Met Ile Arg Ile Phe Arg Leu Phe Lys Leu Thr
            325             330             335

Gln His His Gln Gly Leu Gln Ile Leu Ile His Thr Phe Arg Ala Ser
        340             345             350

Ala Lys Glu Leu Ile Leu Leu Val Phe Phe Leu Ile Leu Gly Ile Val
    355             360             365

Ile Phe Ala Ala Leu Val Tyr Tyr Ala Glu Lys Met Glu Ala Asn Pro
    370             375             380

Asn Asn Gln Phe Gln Ser Ile Pro Leu Gly Leu Trp Trp Ala Ile Cys
385             390             395                 400

Thr Met Thr Thr Val Gly Tyr Gly Asp Met Thr Pro His Thr Ser Phe
                405             410             415

Gly Arg Leu Val Gly Ser Leu Cys Ala Val Met Gly Val Leu Thr Ile
            420             425             430

Ala Leu Pro Val Pro Val Ile Val Ser Asn Phe Ala Met Phe Tyr Ser
            435             440             445

His Asn Gln Ala Arg Asp Lys Leu Pro Lys Arg Arg Arg Arg Val Leu
    450             455             460

Pro Val Glu Gln Ile Arg Leu Gln Ala Arg Arg His Ala Ala Val Leu
465             470             475                 480

Glu Pro Ser Ala Ser Gln Gly Gly Leu Gly Gly Gln Ala Ile Arg
            485             490             495

Arg Arg Asn Met Pro Ile Leu Ile Asp Gln Asn Cys Cys Asp Glu Glu
        500             505             510
```

Asn His Asn His Lys Asp Arg Glu Lys Ser Glu Asn Ser Asp Glu Gly
     515   520   525

Thr Asn Ser Ser Ser Thr Thr Gly Val Asp Thr Val Val Lys Leu Gly
     530   535   540

Pro Ser Glu Thr Ala Ile Thr Thr Thr Ile Ile Ser
545   550   555

<210> 9
<211> 1196
<212> PRT
<213> Mus musculus

<400> 9
Met Glu Leu Glu His Pro Lys Ser Pro Pro Tyr Pro Ser Ser Ser Ser
  1   5   10   15

Ser Ser Ser Ser Ser Ser Val His Glu Pro Lys Met Asp Ala Leu Ile
         20   25   30

Ile Pro Val Thr Met Glu Val Pro Cys Asp Ser Arg Gly Gln Arg Met
     35   40   45

Trp Trp Ala Phe Leu Ala Ser Ser Met Val Thr Phe Phe Gly Gly Leu
     50   55   60

Phe Ile Ile Leu Leu Trp Arg Thr Leu Lys Tyr Leu Trp Thr Val Cys
65   70   75   80

Cys His Cys Gly Gly Lys Thr Lys Glu Ala Gln Lys Ile Asn Asn Gly
         85   90   95

Ser Ser Gln Ala Asp Gly Thr Leu Lys Pro Val Asp Glu Lys Glu Glu
         100   105   110

Val Val Ala Ala Glu Val Gly Trp Met Thr Ser Val Lys Asp Trp Ala
        115   120   125

Gly Val Met Ile Ser Ala Gln Thr Leu Thr Gly Arg Val Leu Val Val
        130   135   140

Leu Val Phe Ala Leu Ser Ile Gly Ala Leu Val Ile Tyr Phe Ile Asp
145   150   155   160

Ser Ser Asn Pro Ile Glu Ser Cys Gln Asn Phe Tyr Lys Asp Phe Thr
         165   170   175

Leu Gln Ile Asp Met Ala Phe Asn Val Phe Phe Leu Leu Tyr Phe Gly
        180   185   190

Leu Arg Phe Ile Ala Ala Asn Asp Lys Leu Trp Phe Trp Leu Glu Val
        195   200   205

Asn Ser Val Val Asp Phe Phe Thr Val Pro Pro Val Phe Val Ser Val
     210   215   220

Tyr Leu Asn Arg Ser Trp Leu Gly Leu Arg Phe Leu Arg Ala Leu Arg
225   230   235   240

```
Leu Ile Gln Phe Ser Glu Ile Leu Gln Phe Leu Asn Ile Leu Lys Thr
            245             250              255

Ser Asn Ser Ile Lys Leu Val Asn Leu Leu Ser Ile Phe Ile Ser Thr
            260             265              270

Trp Leu Thr Ala Ala Gly Phe Ile His Leu Val Glu Asn Ser Gly Asp
        275             280             285

Pro Trp Glu Asn Phe Gln Asn Asn Gln Ala Leu Thr Tyr Trp Glu Cys
    290             295             300

Val Tyr Leu Leu Met Val Thr Met Ser Thr Val Gly Tyr Gly Asp Val
305             310             315             320

Tyr Ala Lys Thr Thr Leu Gly Arg Leu Phe Met Val Phe Phe Ile Leu
            325             330             335

Gly Gly Leu Ala Met Phe Ala Ser Tyr Val Pro Glu Ile Ile Glu Leu
            340             345             350

Ile Gly Asn Arg Lys Lys Tyr Gly Gly Ser Tyr Ser Ala Val Ser Gly
        355             360             365

Arg Lys His Ile Val Val Cys Gly His Ile Thr Leu Glu Ser Val Ser
    370             375             380

Asn Phe Leu Lys Asp Phe Leu His Lys Asp Arg Asp Asp Val Asn Val
385             390             395             400

Glu Ile Val Phe Leu His Asn Ile Ser Pro Asn Leu Glu Leu Glu Ala
            405             410             415

Leu Phe Lys Arg His Phe Thr Gln Val Glu Phe Tyr Gln Gly Ser Val
        420             425             430

Leu Asn Pro His Asp Leu Ala Arg Val Lys Ile Glu Ser Ala Asp Ala
        435             440             445

Cys Leu Ile Leu Ala Asn Lys Tyr Cys Ala Asp Pro Asp Ala Glu Asp
450             455             460

Ala Ser Asn Ile Met Arg Val Ile Ser Ile Lys Asn Tyr His Pro Lys
465             470             475             480

Ile Arg Ile Ile Thr Gln Met Leu Gln Tyr His Asn Lys Ala His Leu
            485             490             495

Leu Asn Ile Pro Ser Trp Asn Trp Lys Glu Gly Asp Asp Ala Ile Cys
            500             505             510

Leu Ala Glu Leu Lys Leu Gly Phe Ile Ala Gln Ser Cys Leu Ala Gln
        515             520             525

Gly Leu Ser Thr Met Leu Ala Asn Leu Phe Ser Met Arg Ser Phe Ile
    530             535             540

Lys Ile Glu Glu Asp Thr Trp Gln Lys Tyr Tyr Leu Glu Gly Val Ser
545             550             555             560
```

Asn Glu Met Tyr Thr Glu Tyr Leu Ser Ser Ala Phe Val Gly Leu Ser
                    565   570   575

Phe Pro Thr Val Cys Glu Leu Cys Phe Val Lys Leu Lys Leu Leu Met
            580   585   590

Ile Ala Ile Glu Tyr Lys Ser Ala Asn Arg Glu Ser Arg Ile Leu Ile
        595   600   605

Asn Pro Gly Asn His Leu Lys Ile Gln Glu Gly Thr Leu Gly Phe Phe
    610   615   620

Ile Ala Ser Asp Ala Lys Glu Val Lys Arg Ala Phe Phe Tyr Cys Lys
625   630   635   640

Ala Cys His Asp Asp Val Thr Asp Pro Lys Arg Ile Lys Lys Cys Gly
            645   650   655

Cys Arg Arg Leu Ile Tyr Phe Glu Asp Glu Gln Pro Pro Thr Leu Ser
            660   665   670

Pro Lys Lys Lys Gln Arg Asn Gly Gly Met Arg Asn Ser Pro Asn Thr
    675   680   685

Ser Pro Lys Leu Met Arg His Asp Pro Leu Leu Ile Pro Gly Asn Asp
    690   695   700

Gln Ile Asp Asn Met Asp Ser Asn Val Lys Lys Tyr Asp Ser Thr Gly
705   710   715   720

Met Phe His Trp Cys Ala Pro Lys Glu Ile Glu Lys Val Ile Leu Thr
            725   730   735

Arg Ser Glu Ala Ala Met Thr Val Leu Ser Gly His Val Val Val Cys
            740   745   750

Ile Phe Gly Asp Val Ser Ser Ala Leu Ile Gly Leu Arg Asn Leu Val
        755   760   765

Met Pro Leu Arg Ala Ser Asn Phe His Tyr His Glu Leu Lys His Ile
    770   775   780

Val Phe Val Gly Ser Ile Glu Tyr Leu Lys Arg Glu Trp Glu Thr Leu
785   790   795   800

His Asn Phe Pro Lys Val Ser Ile Leu Pro Gly Thr Pro Leu Ser Arg
            805   810   815

Ala Asp Leu Arg Ala Val Asn Ile Asn Leu Cys Asp Met Cys Val Ile
        820   825   830

Leu Ser Ala Asn Gln Asn Asn Ile Asp Asp Thr Ser Leu Gln Asp Lys
        835   840   845

Glu Cys Ile Leu Ala Ser Leu Asn Ile Lys Ser Met Gln Phe Asp Asp
    850   855   860

Ser Ile Gly Val Leu Gln Ala Asn Ser Gln Gly Phe Thr Pro Pro Gly
865   870   875   880

Met Asp Arg Ser Ser Pro Asp Asn Ser Pro Val His Gly Met Leu Arg
                  885   890   895

Gln Pro Ser Ile Thr Thr Gly Val Asn Ile Pro Ile Ile Thr Glu Leu
              900   905   910

Val Asn Asp Thr Asn Val Gln Phe Leu Asp Gln Asp Asp Asp Asp Asp
          915   920   925

Pro Asp Thr Glu Leu Tyr Leu Thr Gln Pro Phe Ala Cys Gly Thr Ala
    930   935   940

Phe Ala Val Ser Val Leu Asp Ser Leu Met Ser Ala Thr Tyr Phe Asn
945   950   955   960

Asp Asn Ile Leu Thr Leu Ile Arg Thr Leu Val Thr Gly Gly Ala Thr
              965   970   975

Pro Glu Leu Glu Ala Leu Ile Ala Glu Glu Asn Ala Leu Arg Gly Gly
          980   985   990

Tyr Ser Thr Pro Gln Thr Leu Ala Asn Arg Asp Arg Cys Arg Val Ala
          995   1000   1005

Gln Leu Ala Leu Leu Asp Gly Pro Phe Ala Asp Leu Gly Asp Gly Gly
    1010   1015   1020

Cys Tyr Gly Asp Leu Phe Cys Lys Ala Leu Lys Thr Tyr Asn Met Leu
1025   1030   1035   1040

Cys Phe Gly Ile Tyr Arg Leu Arg Asp Ala His Leu Ser Thr Pro Ser
              1045   1050   1055

Gln Cys Thr Lys Arg Tyr Val Ile Thr Asn Pro Pro Tyr Glu Phe Glu
          1060   1065   1070

Leu Val Pro Thr Asp Leu Ile Phe Cys Leu Met Gln Phe Asp His Asn
        1075   1080   1085

Ala Gly Gln Ser Arg Ala Ser Leu Ser His Ser Ser His Ser Ser Gln
    1090   1095   1100

Ser Ser Ser Lys Lys Ser Ser Ser Val His Ser Ile Pro Ser Thr Ala
1105   1110   1115   1120

Asn Arg Pro Asn Arg Pro Lys Ser Arg Glu Ser Arg Asp Lys Gln Asn
              1125   1130   1135

Ala Thr Arg Met Thr Arg Met Gly Gln Ala Glu Lys Lys Trp Phe Thr
          1140   1145   1150

Asp Glu Pro Asp Asn Ala Tyr Pro Arg Asn Ile Gln Ile Lys Pro Met
    1155   1160   1165

Ser Thr His Met Ala Asn Gln Ile Asn Gln Tyr Lys Ser Thr Ser Ser
    1170   1175   1180

Leu Ile Pro Pro Ile Arg Glu Val Glu Asp Glu Cys
1185   1190   1195

<210> 10
<211> 731
<212> PRT
<213> Homo sapiens

<400> 10
Met Asp Thr Ser Gly His Phe His Asp Ser Gly Val Gly Asp Leu Asp
 1   5   10   15

Glu Asp Pro Lys Cys Pro Cys Pro Ser Ser Gly Asp Glu Gln Gln Gln
                20   25   30

Gln Gln Gln Gln Gln Gln Gln Gln Gln Pro Pro Pro Pro Ala Ser Pro
            35   40   45

Ala Ala Pro Gln Gln Pro Leu Gly Pro Ser Leu Gln Pro Gln Pro Pro
    50   55   60

Gln Leu Gln Gln Gln Gln Gln Gln Gln Gln Gln Gln Gln Gln Gln Gln
65   70   75   80

Ser Pro His Pro Leu Ser Gln Leu Ala Gln Leu Gln Ser Gln Pro Val
                85   90   95

His Pro Gly Leu Leu His Ser Ser Pro Thr Ala Phe Arg Ala Pro Pro
            100   105   110

Ser Ser Asn Ser Thr Ala Ile Leu His Pro Ser Ser Arg Gln Gly Ser
            115   120   125

Gln Leu Asn Leu Asn Asp His Leu Leu Gly His Ser Pro Ser Ser Thr
    130   135   140

Ala Thr Ser Gly Pro Gly Gly Gly Ser Arg His Arg Gln Ala Ser Pro
145   150   155   160

Leu Val His Arg Arg Asp Ser Asn Pro Phe Thr Glu Ile Ala Met Ser
            165   170   175

Ser Cys Lys Tyr Ser Gly Gly Val Met Lys Pro Leu Ser Arg Phe Ser
            180   185   190

Ala Ser Arg Arg Asn Leu Ile Glu Ala Glu Thr Glu Gly Gln Pro Leu
            195   200   205

Gln Leu Phe Ser Pro Ser Asn Pro Pro Glu Ile Val Ile Ser Ser Arg
    210   215   220

Glu Asp Asn His Ala His Gln Thr Leu Leu His His Pro Asn Ala Thr
225   230   235   240

His Asn His Gln His Ala Gly Thr Thr Ala Ser Ser Thr Thr Phe Pro
            245   250   255

Lys Ala Asn Lys Arg Lys Asn Gln Asn Ile Gly Tyr Lys Leu Gly His
            260   265   270

Arg Arg Ala Leu Phe Glu Lys Arg Lys Arg Leu Ser Asp Tyr Ala Leu
    275   280   285

Ile Phe Gly Met Phe Gly Ile Val Val Met Val Ile Glu Thr Glu Leu
    290   295   300

Ser Trp Gly Leu Tyr Ser Lys Asp Ser Met Phe Ser Leu Ala Leu Lys
305   310   315   320

Cys Arg Ile Ser Leu Ser Thr Ile Ile Leu Leu Gly Leu Ile Ile Ala
            325   330   335

Tyr His Thr Arg Gly Val Gln Leu Phe Val Ile Asp Asn Asp Ala Asp
            340   345   350

Asp Trp Arg Ile Ala Met Thr Tyr Glu Arg Ile Leu Tyr Ile Ser Leu
        355   360   365

Glu Met Leu Val Tyr Thr Asn His Thr Ile Pro Gly Glu Tyr Lys Phe
    370   375   380

Phe Trp Ala Ala Arg Leu Ala Phe Ser Tyr Thr Pro Ser Arg Ala Glu
385   390   395   400

Ala Asp Val Asp Ile Ile Leu Ser Ile Pro Met Phe Leu Arg Leu Tyr
            405   410   415

Leu Ile Ala Arg Val Met Leu Leu His Ser Lys Leu Phe Thr Asp Ala
        420   425   430

Ser Ser Arg Ser Ile Gly Ala Leu Asn Lys Ile Asn Phe Asn Thr Arg
        435   440   445

Phe Val Met Lys Thr Leu Met Thr Ile Cys Pro Gly Thr Val Leu Leu
    450   455   460

Val Phe Ser Ile Ser Leu Trp Ile Ile Ala Ala Trp Thr Val Arg Val
465   470   475   480

Cys Glu Arg Tyr His Asp Gln Gln Asp Val Thr Ser Asn Phe Leu Gly
            485   490   495

Ala Met Trp Leu Ile Ser Ile Thr Phe Leu Ser Ile Gly Tyr Gly Asp
        500   505   510

Met Val Pro His Thr Tyr Cys Gly Lys Gly Val Cys Leu Leu Thr Gly
    515   520   525

Ile Met Gly Ala Gly Cys Thr Ala Leu Val Val Ala Val Val Ala Arg
    530   535   540

Lys Leu Glu Leu Thr Lys Ala Glu Lys His Val Asp Asn Phe Met Met
545   550   555   560

Asp Thr Gln Leu Thr Lys Arg Ile Lys Asn Ala Ala Ala Asn Val Leu
            565   570   575

Arg Glu Thr Trp Leu Ile Tyr Lys His Thr Lys Leu Leu Lys Lys Ile
        580   585   590

Asp His Ala Lys Val Arg Lys His Gln Arg Lys Phe Leu Gln Ala Ile
        595   600   605

```
His Gln Leu Arg Ser Val Lys Met Glu Gln Arg Lys Leu Ser Asp Gln
    610             615             620
```

```
Ala Asn Thr Leu Val Asp Leu Ser Lys Met Gln Asn Val Met Tyr Asp
625             630             635                     640
```

```
Leu Ile Thr Glu Leu Asn Asp Arg Ser Glu Asp Leu Glu Lys Gln Ile
                645             650                     655
```

```
Gly Ser Leu Glu Ser Lys Leu Glu His Leu Thr Ala Ser Phe Asn Ser
                660             665             670
```

```
Leu Pro Leu Leu Ile Ala Asp Thr Leu Arg Gln Gln Gln Gln Gln Leu
        675             680             685
```

```
Leu Ser Ala Ile Ile Glu Ala Arg Gly Val Ser Val Ala Val Gly Thr
        690             695             700
```

```
Thr His Thr Pro Ile Ser Asp Thr Pro Ile Gly Val Ser Ser Thr Ser
705             710             715                     720
```

```
Phe Pro Thr Pro Tyr Thr Ser Ser Ser Cys
                725             730
```

<210> 11
<211> 857
<212> PRT
<213> Arabidopsis thaliana

<400> 11
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Met Arg Gly Gly Ala Leu Leu Cys Gly Gln Val Gln Asp Glu Ile Glu
  1             5               10                  15
```

```
Gln Leu Ser Arg Glu Ser Ser His Phe Ser Leu Ser Thr Gly Ile Leu
            20              25              30
```

```
Pro Ser Leu Gly Ala Arg Ser Asn Arg Arg Val Lys Leu Arg Arg Phe
        35              40              45
```

```
Val Val Ser Pro Tyr Asp His Lys Tyr Arg Ile Trp Glu Ala Phe Leu
    50              55              60
```

```
Val Val Leu Val Val Tyr Thr Ala Trp Val Ser Pro Phe Glu Phe Gly
65              70              75                      80
```

```
Phe Leu Arg Lys Pro Arg Pro Pro Leu Ser Ile Thr Asp Asn Ile Val
            85              90                  95
```

```
Asn Ala Phe Phe Ala Ile Asp Ile Ile Met Thr Phe Phe Val Gly Tyr
            100             105                 110
```

```
Leu Asp Lys Ser Thr Tyr Leu Ile Val Asp Asp Arg Lys Gln Ile Ala
            115             120             125
```

```
Phe Lys Tyr Leu Arg Ser Trp Phe Leu Leu Asp Leu Val Ser Thr Ile
        130             135             140
```

```
Pro Ser Glu Ala Ala Met Arg Ile Ser Ser Gln Ser Tyr Gly Leu Phe
145             150             155                     160
```

Asn Met Leu Arg Leu Trp Arg Leu Arg Arg Val Gly Ala Leu Phe Ala
            165   170   175

Arg Leu Glu Lys Asp Arg Asn Phe Asn Tyr Phe Trp Val Arg Cys Ala
            180   185   190

Lys Leu Val Cys Val Thr Leu Phe Ala Val His Cys Ala Ala Cys Phe
            195   200   205

Tyr Tyr Leu Ile Ala Ala Arg Asn Ser Asn Pro Ala Lys Thr Trp Ile
    210   215   220

Gly Ala Asn Val Ala Asn Phe Leu Glu Glu Ser Leu Trp Met Arg Tyr
225   230   235   240

Val Thr Ser Met Tyr Trp Ser Ile Thr Thr Leu Thr Thr Val Gly Tyr
            245   250   255

Gly Asp Leu His Pro Val Asn Thr Lys Glu Met Ile Phe Asp Ile Phe
            260   265   270

Tyr Met Leu Phe Asn Leu Gly Leu Thr Ala Tyr Leu Ile Gly Asn Met
    275   280   285

Thr Asn Leu Val Val His Gly Thr Ser Arg Thr Arg Asn Phe Arg Asp
    290   295   300

Thr Ile Gln Ala Ala Ser Asn Phe Ala His Arg Asn His Leu Pro Pro
305   310   315   320

Arg Leu Gln Asp Gln Met Leu Ala His Leu Cys Leu Lys Tyr Arg Thr
            325   330   335

Asp Ser Glu Gly Leu Gln Gln Gln Glu Thr Leu Asp Ala Leu Pro Lys
            340   345   350

Ala Ile Arg Ser Ser Ile Ser His Phe Leu Phe Tyr Ser Leu Met Asp
    355   360   365

Lys Val Tyr Leu Phe Arg Gly Val Ser Asn Asp Leu Leu Phe Gln Leu
    370   375   380

Val Ser Glu Met Lys Ala Glu Tyr Phe Pro Pro Lys Glu Asp Val Ile
385   390   395   400

Leu Gln Asn Glu Ala Pro Thr Asp Phe Tyr Ile Leu Val Asn Gly Thr
            405   410   415

Ala Asp Leu Val Asp Val Asp Thr Gly Thr Glu Ser Ile Val Arg Glu
            420   425   430

Val Lys Ala Gly Asp Ile Ile Gly Glu Ile Gly Val Leu Cys Tyr Arg
            435   440   445

Pro Gln Leu Phe Thr Val Arg Thr Lys Arg Leu Cys Gln Leu Leu Arg
    450   455   460

Met Asn Arg Thr Thr Phe Leu Asn Ile Ile Gln Ala Asn Val Gly Asp
465   470   475   480

Gly Thr Ile Ile Met Asn Asn Leu Leu Gln His Leu Lys Glu Met Asn
                485   490   495

Asp Pro Val Met Thr Asn Val Leu Leu Glu Ile Glu Asn Met Leu Ala
                500   505   510

Arg Gly Lys Met Asp Leu Pro Leu Asn Leu Cys Phe Ala Ala Ile Arg
        515   520   525

Glu Asp Asp Leu Leu Leu His Gln Leu Leu Lys Arg Gly Leu Asp Pro
    530   535   540

Asn Glu Ser Asp Asn Asn Gly Arg Thr Pro Leu His Ile Ala Ala Ser
545   550   555   560

Lys Gly Thr Leu Asn Cys Val Leu Leu Leu Leu Glu Tyr His Ala Asp
                565   570   575

Pro Asn Cys Arg Asp Ala Glu Gly Ser Val Pro Leu Trp Glu Ala Met
                580   585   590

Val Glu Gly His Glu Lys Val Val Lys Val Leu Leu Glu His Gly Ser
        595   600   605

Thr Ile Asp Ala Gly Asp Val Gly His Phe Ala Cys Thr Ala Ala Glu
    610   615   620

Gln Gly Asn Leu Lys Leu Leu Lys Glu Ile Val Leu His Gly Gly Asp
625   630   635   640

Val Thr Arg Pro Arg Ala Thr Gly Thr Ser Ala Leu His Thr Ala Val
                645   650   655

Cys Glu Glu Asn Ile Glu Met Val Lys Tyr Leu Leu Glu Gln Gly Ala
                660   665   670

Asp Val Asn Lys Gln Asp Met His Gly Trp Thr Pro Arg Asp Leu Ala
        675   680   685

Glu Gln Gln Gly His Glu Asp Ile Lys Ala Leu Phe Arg Glu Lys Leu
    690   695   700

His Glu Arg Arg Val His Ile Glu Thr Ser Ser Ser Val Pro Ile Leu
705   710   715   720

Lys Thr Gly Ile Arg Phe Leu Gly Arg Phe Thr Ser Glu Pro Asn Ile
                725   730   735

Arg Pro Ala Ser Arg Glu Val Ser Phe Arg Ile Arg Glu Thr Arg Ala
                740   745   750

Arg Arg Lys Thr Asn Asn Phe Asp Asn Ser Leu Phe Gly Ile Leu Ala
        755   760   765

Asn Gln Ser Val Pro Lys Asn Gly Leu Ala Thr Val Asp Glu Gly Arg
    770   775   780

Thr Gly Asn Pro Val Arg Val Thr Ile Ser Cys Ala Glu Lys Asp Asp
785   790   795   800

```
Ile Ala Gly Lys Leu Val Leu Leu Pro Gly Ser Phe Lys Glu Leu Leu
            805             810             815

Glu Leu Gly Ser Asn Lys Phe Gly Ile Val Ala Thr Lys Val Met Asn
            820             825             830

Lys Asp Asn Asn Ala Glu Ile Asp Asp Val Asp Val Ile Arg Asp Gly
            835             840             845

Asp His Leu Ile Phe Ala Thr Asp Ser
    850             855
```

<210> 12
<211> 1159
<212> PRT
<213> Homo sapiens

<400> 12
```
Met Pro Val Arg Arg Gly His Val Ala Pro Gln Asn Thr Phe Leu Asp
 1           5               10              15

Thr Ile Ile Arg Lys Phe Glu Gly Gln Ser Arg Lys Phe Ile Ile Ala
            20              25              30

Asn Ala Arg Val Glu Asn Cys Ala Val Ile Tyr Cys Asn Asp Gly Phe
            35              40              45

Cys Glu Leu Cys Gly Tyr Ser Arg Ala Glu Val Met Gln Arg Pro Cys
    50              55              60

Thr Cys Asp Phe Leu His Gly Pro Arg Thr Gln Arg Arg Ala Ala Ala
65              70              75              80

Gln Ile Ala Gln Ala Leu Leu Gly Ala Glu Glu Arg Lys Val Glu Ile
            85              90              95

Ala Phe Tyr Arg Lys Asp Gly Ser Cys Phe Leu Cys Leu Val Asp Val
            100             105             110

Val Pro Val Lys Asn Glu Asp Gly Ala Val Ile Met Phe Ile Leu Asn
    115             120             125

Phe Glu Val Val Met Glu Lys Asp Met Val Gly Ser Pro Ala His Asp
    130             135             140

Thr Asn His Arg Gly Pro Pro Thr Ser Trp Leu Ala Pro Gly Arg Ala
145             150             155             160

Lys Thr Phe Arg Leu Lys Leu Pro Ala Leu Leu Ala Leu Thr Ala Arg
            165             170             175

Glu Ser Ser Val Arg Ser Gly Gly Ala Gly Gly Ala Gly Ala Pro Gly
            180             185             190

Ala Val Val Val Asp Val Asp Leu Thr Pro Ala Ala Pro Ser Ser Glu
            195             200             205

Ser Leu Ala Leu Asp Glu Val Thr Ala Met Asp Asn His Val Ala Gly
    210             215             220
```

Leu Gly Pro Ala Glu Glu Arg Arg Ala Leu Val Gly Pro Gly Ser Pro
225   230   235   240

Pro Arg Ser Ala Pro Gly Gln Leu Pro Ser Pro Arg Ala His Ser Leu
            245   250   255

Asn Pro Asp Ala Ser Gly Ser Ser Cys Ser Leu Ala Arg Thr Arg Ser
            260   265   270

Arg Glu Ser Cys Ala Ser Val Arg Arg Ala Ser Ser Ala Asp Asp Ile
        275   280   285

Glu Ala Met Arg Ala Gly Val Leu Pro Pro Pro Arg His Ala Ser
    290   295   300

Thr Gly Ala Met His Pro Leu Arg Ser Gly Leu Leu Asn Ser Thr Ser
305   310   315   320

Asp Ser Asp Leu Val Arg Tyr Arg Thr Ile Ser Lys Ile Pro Gln Ile
            325   330   335

Thr Leu Asn Phe Val Asp Leu Lys Gly Asp Pro Phe Leu Ala Ser Pro
            340   345   350

Thr Ser Asp Arg Glu Ile Ile Ala Pro Lys Ile Lys Glu Arg Thr His
        355   360   365

Asn Val Thr Glu Lys Val Thr Gln Val Leu Ser Leu Gly Ala Asp Val
    370   375   380

Leu Pro Glu Tyr Lys Leu Gln Ala Pro Arg Ile His Arg Trp Thr Ile
385   390   395   400

Leu His Tyr Ser Pro Phe Lys Ala Val Trp Asp Trp Leu Ile Leu Leu
            405   410   415

Leu Val Ile Tyr Thr Ala Val Phe Thr Pro Tyr Ser Ala Ala Phe Leu
            420   425   430

Leu Lys Glu Thr Glu Glu Gly Pro Pro Ala Thr Glu Cys Gly Tyr Ala
        435   440   445

Cys Gln Pro Leu Ala Val Val Asp Leu Ile Val Asp Ile Met Phe Ile
    450   455   460

Val Asp Ile Leu Ile Asn Phe Arg Thr Thr Tyr Val Asn Ala Asn Glu
465   470   475   480

Glu Val Val Ser His Pro Gly Arg Ile Ala Val His Tyr Phe Lys Gly
            485   490   495

Trp Phe Leu Ile Asp Met Val Ala Ala Ile Pro Phe Asp Leu Leu Ile
            500   505   510

Phe Gly Ser Gly Ser Glu Glu Leu Ile Gly Leu Leu Lys Thr Ala Arg
        515   520   525

Leu Leu Arg Leu Val Arg Val Ala Arg Lys Leu Asp Arg Tyr Ser Glu
530   535   540

```
Tyr Gly Ala Ala Val Leu Phe Leu Leu Met Cys Thr Phe Ala Leu Ile
545             550             555             560

Ala His Trp Leu Ala Cys Ile Trp Tyr Ala Ile Gly Asn Met Glu Gln
            565             570             575

Pro His Met Asp Ser Arg Ile Gly Trp Leu His Asn Leu Gly Asp Gln
            580             585             590

Ile Gly Lys Pro Tyr Asn Ser Ser Gly Leu Gly Gly Pro Ser Ile Lys
        595             600             605

Asp Lys Tyr Val Thr Ala Leu Tyr Phe Thr Phe Ser Ser Leu Thr Ser
    610             615             620

Val Gly Phe Gly Asn Val Ser Pro Asn Thr Asn Ser Glu Lys Ile Phe
625             630             635             640

Ser Ile Cys Val Met Leu Ile Gly Ser Leu Met Tyr Ala Ser Ile Phe
            645             650             655

Gly Asn Val Ser Ala Ile Ile Gln Arg Leu Tyr Ser Gly Thr Ala Arg
            660             665             670

Tyr His Thr Gln Met Leu Arg Val Arg Glu Phe Ile Arg Phe His Gln
    675             680             685

Ile Pro Asn Pro Leu Arg Gln Arg Leu Glu Glu Tyr Phe Gln His Ala
    690             695             700

Trp Ser Tyr Thr Asn Gly Ile Asp Met Asn Ala Val Leu Lys Gly Phe
705             710             715             720

Pro Glu Cys Leu Gln Ala Asp Ile Cys Leu His Leu Asn Arg Ser Leu
            725             730             735

Leu Gln His Cys Lys Pro Phe Arg Gly Ala Thr Lys Gly Cys Leu Arg
            740             745             750

Ala Leu Ala Met Lys Phe Lys Thr Thr His Ala Pro Pro Gly Asp Thr
            755             760             765

Leu Val His Ala Gly Asp Leu Leu Thr Ala Leu Tyr Phe Ile Ser Arg
    770             775             780

Gly Ser Ile Glu Ile Leu Arg Gly Asp Val Val Val Ala Ile Leu Gly
785             790             795             800

Lys Asn Asp Ile Phe Gly Glu Pro Leu Asn Leu Tyr Ala Arg Pro Gly
            805             810             815

Lys Ser Asn Gly Asp Val Arg Ala Leu Thr Tyr Cys Asp Leu His Lys
            820             825             830

Ile His Arg Asp Asp Leu Leu Glu Val Leu Asp Met Tyr Pro Glu Phe
    835             840             845

Ser Asp His Phe Trp Ser Ser Leu Glu Ile Thr Phe Asn Leu Arg Asp
    850             855             860
```

Thr Asn Met Ile Pro Gly Ser Pro Gly Ser Thr Glu Leu Glu Gly Gly
865   870   875   880

Phe Ser Arg Gln Arg Lys Arg Lys Leu Ser Phe Arg Arg Arg Thr Asp
                885   890   895

Lys Asp Thr Glu Gln Pro Gly Glu Val Ser Ala Leu Gly Pro Gly Arg
            900   905   910

Ala Gly Ala Gly Pro Ser Ser Arg Gly Arg Pro Gly Gly Pro Trp Gly
        915   920   925

Glu Ser Pro Ser Ser Gly Pro Ser Ser Pro Glu Ser Ser Glu Asp Glu
    930   935   940

Gly Pro Gly Arg Ser Ser Ser Pro Leu Arg Leu Val Pro Phe Ser Ser
945   950   955   960

Pro Arg Pro Pro Gly Glu Pro Pro Gly Gly Glu Pro Leu Met Glu Asp
            965   970   975

Cys Glu Lys Ser Ser Asp Thr Cys Asn Pro Leu Ser Gly Ala Phe Ser
        980   985   990

Gly Val Ser Asn Ile Phe Ser Phe Trp Gly Asp Ser Arg Gly Arg Gln
        995   1000   1005

Tyr Gln Glu Leu Pro Arg Cys Pro Ala Pro Thr Pro Ser Leu Leu Asn
    1010   1015   1020

Ile Pro Leu Ser Ser Pro Gly Arg Arg Pro Arg Gly Asp Val Glu Ser
1025   1030   1035   1040

Arg Leu Asp Ala Leu Gln Arg Gln Leu Asn Arg Leu Glu Thr Arg Leu
            1045   1050   1055

Ser Ala Asp Met Ala Thr Val Leu Gln Leu Leu Gln Arg Gln Met Thr
            1060   1065   1070

Leu Val Pro Pro Ala Tyr Ser Ala Val Thr Thr Pro Gly Pro Gly Pro
        1075   1080   1085

Thr Ser Thr Ser Pro Leu Leu Pro Val Ser Pro Leu Pro Thr Leu Thr
    1090   1095   1100

Leu Asp Ser Leu Ser Gln Val Ser Gln Phe Met Ala Cys Glu Glu Leu
1105   1110   1115   1120

Pro Pro Gly Ala Pro Glu Leu Pro Gln Glu Gly Pro Thr Arg Arg Leu
            1125   1130   1135

Ser Leu Pro Gly Gln Leu Gly Ala Leu Thr Ser Gln Pro Leu His Arg
        1140   1145   1150

His Gly Ser Asp Pro Gly Ser
        1155

<210> 13
<211> 391
<212> PRT
<213> Rattus norvegicus

<400> 13

```
Met Gly Ala Ser Glu Arg Ser Val Phe Arg Val Leu Ile Arg Ala Leu
  1               5                  10                  15

Thr Glu Arg Met Phe Lys His Leu Arg Arg Trp Phe Ile Thr His Ile
             20                  25                  30

Phe Gly Arg Ser Arg Gln Arg Ala Arg Leu Val Ser Lys Glu Gly Arg
         35                  40                  45

Cys Asn Ile Glu Phe Gly Asn Val Asp Ala Gln Ser Arg Phe Ile Phe
     50                  55                  60

Phe Val Asp Ile Trp Thr Thr Val Leu Asp Leu Lys Trp Arg Tyr Lys
 65                  70                  75                  80

Met Thr Val Phe Ile Thr Ala Phe Leu Gly Ser Trp Phe Leu Phe Gly
                 85                  90                  95

Leu Leu Trp Tyr Val Val Ala Tyr Val His Lys Asp Leu Pro Glu Phe
            100                 105                 110

Tyr Pro Pro Asp Asn Arg Thr Pro Cys Val Glu Asn Ile Asn Gly Met
        115                 120                 125

Thr Ser Ala Phe Leu Phe Ser Leu Glu Thr Gln Val Thr Ile Gly Tyr
    130                 135                 140

Gly Phe Arg Phe Val Thr Glu Gln Cys Ala Thr Ala Ile Phe Leu Leu
145                 150                 155                 160

Ile Phe Gln Ser Ile Leu Gly Val Ile Ile Asn Ser Phe Met Cys Gly
                165                 170                 175

Ala Ile Leu Ala Lys Ile Ser Arg Pro Lys Lys Arg Ala Lys Thr Ile
            180                 185                 190

Thr Phe Ser Lys Asn Ala Val Ile Ser Lys Arg Gly Gly Lys Leu Cys
        195                 200                 205

Leu Leu Ile Arg Val Ala Asn Leu Arg Lys Ser Leu Leu Ile Gly Ser
    210                 215                 220

His Ile Tyr Gly Lys Leu Leu Lys Thr Thr Ile Thr Pro Glu Gly Glu
225                 230                 235                 240

Thr Ile Ile Leu Asp Gln Thr Asn Ile Asn Phe Val Val Asp Ala Gly
            245                 250                 255

Asn Glu Asn Leu Phe Phe Ile Ser Pro Leu Thr Ile Tyr His Ile Ile
        260                 265                 270

Asp His Asn Ser Pro Phe Phe His Met Ala Ala Glu Thr Leu Ser Gln
    275                 280                 285
```

```
Gln Asp Phe Glu Leu Val Val Phe Leu Asp Gly Thr Val Glu Ser Thr
    290             295             300
```

```
Ser Ala Thr Cys Gln Val Arg Thr Ser Tyr Val Pro Glu Glu Val Leu
305             310             315             320
```

```
Trp Gly Tyr Arg Phe Val Pro Ile Val Ser Lys Thr Lys Glu Gly Lys
            325             330             335
```

```
Tyr Arg Val Asp Phe His Asn Phe Gly Lys Thr Val Glu Val Glu Thr
            340             345             350
```

```
Pro His Cys Ala Met Cys Leu Tyr Asn Glu Lys Asp Ala Arg Ala Arg
            355             360             365
```

```
Met Lys Arg Gly Tyr Asp Asn Pro Asn Phe Val Leu Ser Glu Val Asp
    370             375             380
```

```
Glu Thr Asp Asp Thr Gln Met
385             390
```

<210> 14
<211> 407
<212> PRT
<213> Homo sapiens

<400> 14
```
Met Asp Gln Asp Val Glu Ser Pro Val Ala Ile His Gln Pro Lys Leu
  1             5                  10              15
```

```
Pro Lys Gln Ala Arg Asp Asp Leu Pro Arg His Ile Ser Arg Asp Arg
            20              25              30
```

```
Thr Lys Arg Lys Ile Gln Arg Tyr Val Arg Lys Asp Gly Lys Cys Asn
            35              40              45
```

```
Val His His Gly Asn Val Arg Glu Thr Tyr Arg Tyr Leu Thr Asp Ile
    50              55              60
```

```
Phe Thr Thr Leu Val Asp Leu Lys Trp Arg Phe Asn Leu Leu Ile Phe
65              70              75              80
```

```
Val Met Val Tyr Thr Val Thr Trp Leu Phe Phe Gly Met Ile Trp Trp
            85              90              95
```

```
Leu Ile Ala Tyr Ile Arg Gly Asp Met Asp His Ile Glu Asp Ser Pro
            100             105             110
```

```
Trp Thr Pro Cys Val Thr Asn Leu Asn Gly Phe Val Ser Ala Phe Leu
            115             120             125
```

```
Phe Ser Ile Glu Thr Glu Thr Thr Ile Gly Tyr Gly Tyr Arg Val Ile
    130             135             140
```

```
Thr Asp Lys Cys Pro Glu Gly Ile Ile Leu Leu Leu Ile Gln Ser Val
145             150             155             160
```

```
Leu Gly Ser Ile Val Asn Ala Phe Met Val Gly Cys Met Phe Val Lys
            165             170             175
```

```
Ile Ser Gln Pro Lys Lys Arg Ala Glu Thr Leu Val Phe Ser Thr His
            180             185             190

Ala Val Ile Ser Met Arg Asp Gly Lys Leu Cys Leu Met Phe Arg Val
            195             200             205

Gly Asp Leu Arg Asn Ser His Ile Val Glu Ala Ser Ile Arg Ala Lys
    210             215             220

Leu Ile Lys Ser Lys Gln Thr Ser Glu Gly Glu Phe Ile Pro Leu Asn
225             230             235             240

Gln Thr Asp Ile Asn Val Gly Tyr Tyr Thr Gly Asp Asp Arg Leu Phe
            245             250             255

Leu Val Ser Pro Leu Ile Ile Ser His Glu Ile Asn Gln Gln Ser Pro
            260             265             270

Phe Trp Glu Ile Ser Lys Ala Gln Leu Pro Lys Glu Glu Leu Glu Ile
    275             280             285

Val Val Ile Leu Glu Gly Met Val Glu Ala Thr Gly Met Thr Cys Gln
    290             295             300

Ala Arg Ser Ser Tyr Ile Thr Ser Glu Ile Leu Trp Gly Tyr Arg Phe
305             310             315             320

Thr Pro Val Leu Thr Leu Glu Asp Gly Phe Tyr Glu Val Asp Tyr Asn
            325             330             335

Ser Phe His Glu Thr Tyr Glu Thr Ser Thr Pro Ser Leu Ser Ala Lys
            340             345             350

Glu Leu Ala Glu Leu Ala Ser Arg Ala Glu Leu Pro Leu Ser Trp Ser
    355             360             365

Val Ser Ser Lys Leu Asn Gln His Ala Glu Leu Glu Thr Glu Glu Glu
    370             375             380

Glu Lys Asn Leu Glu Glu Gln Thr Glu Arg Asn Gly Asp Val Ala Asn
385             390             395             400

Leu Glu Asn Glu Ser Lys Val
            405
```

<210> 15
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:channel protein
      central pore signature sequence

<400> 15
Thr Val Gly Tyr Gly Asp
  1   5

<210> 16
<211> 160
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:mutated
     prokaryotic kcsa potassium channel protein of
     Streptomyces lividans

<400> 16
```
Met Pro Pro Met Leu Ser Gly Leu Leu Ala Arg Leu Val Lys Leu Leu
 1               5                  10                  15

Leu Gly Arg His Gly Ser Ala Leu His Trp Arg Ala Ala Gly Ala Ala
            20                  25                  30

Thr Val Leu Leu Val Ile Val Leu Leu Ala Gly Ser Tyr Leu Ala Val
        35                  40                  45

Leu Ala Glu Arg Gly Ala Pro Gly Ala Ala Leu Ile Ser Tyr Pro Asp
    50                  55                  60

Ala Leu Trp Trp Ser Val Glu Thr Ala Thr Thr Val Gly Tyr Gly Asp
65                  70                  75                  80

Leu Tyr Pro Val Thr Leu Trp Gly Arg Leu Val Ala Val Val Val Met
            85                  90                  95

Val Ala Gly Ile Thr Ser Phe Gly Leu Val Thr Ala Ala Leu Ala Thr
            100                 105                 110

Trp Phe Val Gly Arg Glu Gln Glu Arg Arg Gly His Phe Val Arg His
        115                 120                 125

Ser Glu Lys Ala Ala Glu Glu Ala Tyr Thr Arg Thr Thr Arg Ala Leu
    130                 135                 140

His Glu Arg Phe Asp Arg Leu Glu Arg Met Leu Asp Asp Asn Arg Arg
145                 150                 155                 160
```

<210> 17
<211> 1161
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:nuclec acid
     encoding mutated prokaryotic kcsa potassium
     channel protein of Streptomyces lividans

<400> 17
```
gcatgctggc tcctttggga tcgatccgtc cggttcttct ccggccggcc acctctcgaa 60
ggtgacgctg tcgccgacga gccaccgaca tccgaccgac agccccgac  agcgctccta 120
cgcggtgccg acatgacacc gacaccgcag gtcggacgac gggggctcag gcgcgacggg 180
cgcggatcac gacggccgta ccgccgcgac ggcgagcacc gccgcgccgc cgaggagtgg 240
ccgaaggagt gaagatcggt tacggaccgt aaaggagtac ctggcgcacc ggcgcgttgt 300
cgcatcgtcg tcccggccgg tggcggagca tgccacccat gctgtccggt cttctggcca 360
gattggtcaa actgctgctc gggcgccacg gcagtgcgct gcactggagg gccgcgggtg 420
ccgcgacggt cctcctggtg atcgtcctcc tcgcgggctc gtacttggcc gtcctggctg 480
```

```
agcgcggcgc accgggcgcg cgcgctgatct cgtatccgga cgcgctgtgg tggtccgtgg 540
agaccgcgac gaccgtcggc tacggcgacc tgtaccccgt gactctgtgg ggccggctcg 600
tggccgtggt ggtgatggtc gccgggatca cctccttcgg tctggtgacc gccgcgctgg 660
ccacctggtt cgtcggccgg gaacaagagc gccggggcca cttcgtgcgc cactccgaga 720
aggccgccga ggaggcgtac acgcggacga cccgggcgct gcacgagcgt ttcgaccgtt 780
tggagcgaat gctcgacgac aaccgccggt gactccgccg gtgaccgccc gagcgaggcc 840
gcaccgatga gtctgcggcg gttgtgcggt ctacccgtcg acgaagggag cgcaccatgc 900
gcaagatcat catttgcacg ttcctgacgc tggacggcgt catgcaggcg ccgggcggcc 960
cggacgagga cgccgagagc ggcttcgaac acggcggctg gcagaagccg gtggacgacg 1020
acgaggtcgg cacggccatc gccggctggt acgaggactc cgacgccatg ctcctcggcc 1080
gcaagaccta cgacatcttc gcgtcgtact ggccgaccgc cgaccccgac aacccgttca 1140
cccatcggat gaacagcatg c                                          1161
```

<210> 18
<211> 261
<212> PRT
<213> Homo sapiens

<400> 18

```
Ile Tyr Tyr Ala Ile Ser Lys Ser Ile Gly Phe Gly Val Asp Thr Trp
 1               5                  10                  15

Val Tyr Pro Asn Ile Thr Asp Pro Glu Tyr Gly Tyr Leu Ala Arg Glu
                20                  25                  30

Tyr Ile Tyr Cys Leu Tyr Trp Ser Thr Leu Thr Leu Thr Thr Ile Gly
            35                  40                  45

Glu Thr Pro Pro Pro Val Lys Asp Glu Glu Tyr Leu Phe Val Ile Phe
        50                  55                  60

Asp Phe Leu Ile Gly Val Leu Ile Phe Ala Thr Ile Val Gly Asn Val
65                  70                  75                  80

Gly Ser Met Ile Ser Asn Met Asn Ala Thr Arg Ala Glu Phe Gln Ala
                85                  90                  95

Lys Ile Asp Ala Val Lys His Tyr Met Gln Phe Arg Lys Val Ser Lys
            100                 105                 110

Gly Met Glu Ala Lys Val Ile Arg Trp Phe Asp Tyr Leu Trp Thr Asn
        115                 120                 125

Lys Lys Thr Val Asp Glu Arg Glu Ile Leu Lys Asn Leu Pro Ala Lys
    130                 135                 140

Leu Arg Ala Glu Ile Ala Ile Asn Val His Leu Ser Thr Leu Lys Lys
145                 150                 155                 160

Val Arg Ile Phe His Asp Cys Glu Ala Gly Leu Leu Val Glu Leu Val
                165                 170                 175

Leu Lys Leu Arg Pro Gln Val Phe Ser Pro Gly Asp Tyr Ile Cys Arg
            180                 185                 190

Lys Gly Asp Ile Gly Lys Glu Met Tyr Ile Ile Lys Glu Gly Lys Leu
        195                 200                 205

Ala Val Val Ala Asp Asp Gly Val Thr Gln Tyr Ala Leu Leu Ser Ala
    210                 215                 220
```

```
Gly Ser Cys Phe Gly Glu Ile Ser Ile Leu Asn Ile Lys Gly Ser Lys
225             230             235             240

Met Gly Asn Arg Arg Thr Ala Asn Ile Arg Ser Leu Gly Tyr Ser Asp
                245             250             255

Leu Phe Cys Leu Ser
                260
```

<210> 19
<211> 690
<212> PRT
<213> Homo sapiens

<400> 19
```
Met Lys Leu Ser Met Lys Asn Asn Ile Ile Asn Thr Gln Gln Ser Phe
  1           5               10              15

Val Thr Met Pro Asn Val Ile Val Pro Asp Ile Glu Lys Glu Ile Arg
            20              25              30

Arg Met Glu Asn Gly Ala Cys Ser Ser Phe Ser Glu Asp Asp Asp Ser
        35              40              45

Ala Tyr Thr Ser Glu Glu Ser Glu Asn Glu Asn Pro His Ala Arg Gly
     50              55              60

Ser Phe Ser Tyr Lys Ser Leu Arg Lys Gly Gly Pro Ser Gln Arg Glu
 65              70              75              80

Gln Tyr Leu Pro Gly Ala Ile Ala Ile Phe Asn Val Asn Asn Ser Ser
            85              90              95

Asn Lys Asp Gln Glu Pro Glu Glu Lys Lys Lys Lys Lys Lys Glu Lys
            100             105             110

Lys Ser Lys Ser Asp Asp Lys Asn Glu Asn Lys Asn Asp Pro Glu Lys
        115             120             125

Lys Lys Lys Lys Lys Asp Lys Glu Lys Lys Lys Glu Glu Lys Ser
        130             135             140

Lys Asp Lys Lys Glu His His Lys Lys Glu Val Val Val Ile Asp Pro
145             150             155             160

Ser Gly Asn Thr Tyr Tyr Asn Trp Leu Phe Cys Ile Thr Leu Pro Val
            165             170             175

Met Tyr Asn Trp Thr Met Val Ile Ala Arg Ala Cys Phe Asp Glu Leu
            180             185             190

Gln Ser Asp Tyr Leu Glu Tyr Trp Leu Ile Leu Asp Tyr Val Ser Asp
        195             200             205

Ile Val Tyr Leu Ile Asp Met Phe Val Arg Thr Arg Thr Gly Tyr Leu
    210             215             220

Glu Gln Gly Leu Leu Val Lys Glu Glu Leu Lys Leu Ile Asn Lys Tyr
225             230             235             240
```

```
Lys Ser Asn Leu Gln Phe Lys Leu Asp Val Leu Ser Leu Ile Pro Thr
                245             250             255

Asp Leu Leu Tyr Phe Lys Leu Gly Trp Asn Tyr Pro Glu Ile Arg Leu
            260             265                 270

Asn Arg Leu Leu Arg Phe Ser Arg Met Phe Glu Phe Phe Gln Arg Thr
        275             280                 285

Glu Thr Arg Thr Asn Tyr Pro Asn Ile Phe Arg Ile Ser Asn Leu Val
    290             295                 300

Met Tyr Ile Val Ile Ile Ile His Trp Asn Ala Cys Val Phe Tyr Ser
305             310             315                 320

Ile Ser Lys Ala Ile Gly Phe Gly Asn Asp Thr Trp Val Tyr Pro Asp
            325             330                 335

Ile Asn Asp Pro Glu Phe Gly Arg Leu Ala Arg Lys Tyr Val Tyr Ser
            340             345                 350

Leu Tyr Trp Ser Thr Leu Thr Leu Thr Thr Ile Gly Glu Thr Pro Pro
        355             360                 365

Pro Val Arg Asp Ser Glu Tyr Val Phe Val Val Val Asp Phe Leu Ile
    370             375             380

Gly Val Leu Ile Phe Ala Thr Ile Val Gly Asn Ile Gly Ser Met Ile
385             390             395                 400

Ser Asn Met Asn Ala Ala Arg Ala Glu Phe Gln Ala Arg Ile Asp Ala
            405             410                 415

Ile Lys Gln Tyr Met His Phe Arg Asn Val Ser Lys Asp Met Glu Lys
            420             425                 430

Arg Val Ile Lys Trp Phe Asp Tyr Leu Trp Thr Asn Lys Lys Thr Val
        435             440             445

Asp Glu Lys Glu Val Leu Lys Tyr Leu Pro Asp Lys Leu Arg Ala Glu
    450             455             460

Ile Ala Ile Asn Val His Leu Asp Thr Leu Lys Lys Val Arg Ile Phe
465             470             475                 480

Ala Asp Cys Glu Ala Gly Leu Leu Val Glu Leu Val Leu Lys Leu Gln
            485             490                 495

Pro Gln Val Tyr Ser Pro Gly Asp Tyr Ile Cys Lys Lys Gly Asp Ile
            500             505                 510

Gly Arg Glu Met Tyr Ile Ile Lys Glu Gly Lys Leu Ala Val Val Ala
        515             520             525

Asp Asp Gly Val Thr Gln Phe Val Val Leu Ser Asp Gly Ser Thr Phe
    530             535             540

Gly Glu Ile Ser Ile Leu Asn Ile Lys Gly Ser Lys Ala Gly Asn Arg
545             550             555                 560
```

```
Arg Thr Ala Asn Ile Lys Ser Ile Gly Tyr Ser Asp Leu Phe Cys Leu
            565             570             575

Ser Lys Asp Asp Leu Met Glu Ala Leu Thr Glu Tyr Pro Asp Ala Lys
            580             585             590

Thr Met Leu Glu Glu Lys Gly Lys Gln Ile Leu Met Lys Asp Gly Leu
            595             600             605

Leu Asp Leu Asn Ile Ala Asn Ala Gly Ser Asp Pro Lys Asp Leu Glu
    610             615             620

Glu Lys Val Thr Arg Met Glu Gly Ser Val Asp Leu Leu Gln Thr Arg
625             630             635             640

Phe Ala Arg Ile Leu Ala Glu Tyr Glu Ser Met Gln Gln Lys Leu Lys
            645             650             655

Gln Arg Leu Thr Lys Val Glu Lys Phe Leu Lys Pro Leu Ile Asp Thr
            660             665             670

Glu Phe Ser Ser Ile Glu Gly Pro Trp Ser Glu Ser Gly Pro Ile Asp
            675             680             685

Ser Thr
    690


<210> 20
<211> 40
<212> PRT
<213> Drosophila melanogaster

<400> 20
Ala Glu Ala Gly Ser Glu Asn Ser Phe Phe Lys Ser Ile Pro Asp Ala
    1               5               10              15

Phe Trp Trp Ala Val Val Thr Met Thr Thr Val Gly Tyr Gly Asp Met
                20              25              30

Thr Pro Val Gly Phe Trp Gly Lys
            35              40


<210> 21
<211> 40
<212> PRT
<213> Rattus norvegicus

<400> 21
Ala Asn His Thr Pro Cys Val Glu Asn Ile Asn Gly Met Thr Ser Ala
    1               5               10              15

Phe Leu Phe Ser Leu Glu Thr Gln Val Thr Ile Gly Tyr Gly Phe Arg
                20              25              30

Cys Val Thr Glu Gln Cys Ala Thr
            35              40
```

```
<210> 22
<211> 42
<212> PRT
<213> Methanococcus jannaschii

<400> 22
Glu Ser Val Ile Leu Met Thr Val Glu Gly Trp Asp Phe Phe Thr Ala
1               5                   10                  15

Phe Tyr Thr Ala Val Val Thr Ile Ser Thr Val Gly Tyr Gly Asp Tyr
            20                  25                  30

Thr Pro Gln Thr Phe Leu Gly Lys Leu Ser
        35                  40


<210> 23
<211> 40
<212> PRT
<213> Streptomyces lividans

<400> 23
Val Leu Ala Glu Arg Pro Gly Ala Gln Leu Ile Thr Tyr Pro Arg Ala
1               5                   10                  15

Leu Trp Trp Ser Val Glu Thr Ala Thr Thr Val Gly Tyr Gly Asp Leu
            20                  25                  30

Tyr Pro Val Thr Leu Trp Gly Arg
        35                  40


<210> 24
<211> 5
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:channel protein
      central pore signature sequence

<400> 24
Thr Val Gly Tyr Gly
1               5


<210> 25
<211> 58
<212> PRT
<213> Streptomyces lividans

<400> 25
Thr Tyr Pro Arg Ala Leu Trp Trp Ser Val Glu Thr Ala Thr Thr Val
1               5                   10                  15

Gly Tyr Gly Asp Leu Tyr Pro Val Thr Leu Trp Gly Arg Leu Val Ala
            20                  25                  30

Val Val Val Met Val Ala Gly Ile Thr Ser Phe Gly Leu Val Thr Ala
            35                  40                  45
```

Ala Leu Ala Thr Trp Phe Val Gly Arg Glu
    50   55

<210> 26
<211> 58
<212> PRT
<213> Escherichia coli

<400> 26
Ser Leu Met Thr Ala Phe Tyr Phe Ser Ile Glu Thr Met Ser Thr Val
  1   5   10   15

Gly Tyr Gly Asp Ile Val Pro Val Ser Glu Ser Ala Arg Leu Phe Thr
          20   25   30

Ile Ser Val Ile Ile Ser Gly Ile Thr Val Phe Ala Thr Ser Met Thr
          35   40   45

Ser Ile Phe Gly Pro Leu Ile Arg Gly Gly
   50   55

<210> 27
<211> 58
<212> PRT
<213> Drosophila melanogaster

<400> 27
Ser Ile Pro Asp Ala Phe Trp Trp Ala Val Val Thr Met Thr Thr Val
  1   5   10   15

Gly Tyr Gly Asp Met Thr Pro Val Gly Phe Trp Gly Lys Ile Val Gly
          20   25   30

Ser Leu Cys Val Ile Ala Gly Val Leu Thr Ile Ala Leu Pro Val Pro
          35   40   45

Val Ile Val Ser Asn Phe Asn Tyr Phe Tyr
   50   55

<210> 28
<211> 58
<212> PRT
<213> Homo sapiens

<400> 28
Ser Ile Pro Asp Ala Phe Trp Trp Ala Val Val Ser Met Thr Thr Val
  1   5   10   15

Gly Tyr Gly Asp Met Tyr Pro Val Thr Ile Gly Gly Lys Ile Val Gly
          20   25   30

Ser Leu Cys Ala Ile Ala Gly Val Leu Thr Ile Ala Leu Pro Val Pro
          35   40   45

Val Ile Val Ser Asn Phe Asn Tyr Phe Tyr
   50   55

<210> 29
<211> 58
<212> PRT
<213> Homo sapiens

<400> 29
Ser Ile Pro Ala Ser Phe Trp Trp Ala Thr Ile Thr Met Thr Thr Val
 1   5   10   15

Gly Tyr Gly Asp Ile Tyr Pro Lys Thr Leu Leu Gly Lys Ile Val Gly
               20   25   30

Gly Leu Cys Cys Ile Ala Gly Val Leu Val Ile Ala Leu Pro Ile Pro
           35   40   45

Ile Ile Val Asn Asn Phe Ser Glu Phe Tyr
       50   55

<210> 30
<211> 58
<212> PRT
<213> Paramecium tetraurelia

<400> 30
Gln Tyr Leu His Ser Leu Tyr Trp Ser Ile Ile Thr Met Thr Thr Ile
 1   5   10   15

Gly Tyr Gly Asp Ile Thr Pro Gln Asn Leu Arg Glu Arg Val Phe Ala
               20   25   30

Val Gly Met Ala Leu Ser Ala Val Gly Val Phe Gly Tyr Ser Ile Gly
           35   40   45

Asn Ile Asn Ser Ile Tyr Ala Glu Trp Ser
       50   55

<210> 31
<211> 58
<212> PRT
<213> Caenorhabditis elegans

<400> 31
Ser Ile Pro Leu Gly Leu Trp Trp Ala Ile Cys Thr Met Thr Thr Val
 1   5   10   15

Gly Tyr Gly Asp Met Thr Pro His Thr Ser Phe Gly Arg Leu Val Gly
               20   25   30

Ser Leu Cys Ala Val Met Gly Val Leu Thr Ile Ala Leu Pro Val Pro
           35   40   45

Val Ile Val Ser Asn Phe Ala Met Phe Tyr
       50   55

<210> 32
<211> 58
<212> PRT
<213> Mus musculus

<400> 32
Thr Tyr Trp Glu Cys Val Tyr Leu Leu Met Val Thr Met Ser Thr Val
 1   5   10   15

Gly Tyr Gly Asp Val Tyr Ala Lys Thr Thr Leu Gly Arg Leu Phe Met
                20   25   30

Val Phe Phe Ile Leu Gly Gly Leu Ala Met Phe Ala Ser Tyr Val Pro
             35   40   45

Glu Ile Ile Glu Leu Ile Gly Asn Arg Lys
        50   55

<210> 33
<211> 58
<212> PRT
<213> Homo sapiens

<400> 33
Asn Phe Leu Gly Ala Met Trp Leu Ile Ser Ile Thr Phe Leu Ser Ile
 1   5   10   15

Gly Tyr Gly Asp Met Val Pro His Thr Tyr Cys Gly Lys Gly Val Cys
                20   25   30

Leu Leu Thr Gly Ile Met Gly Ala Gly Cys Thr Ala Leu Val Val Ala
             35   40   45

Val Val Ala Arg Lys Leu Glu Leu Thr Lys
        50   55

<210> 34
<211> 58
<212> PRT
<213> Arabidopsis thaliana

<400> 34
Arg Tyr Val Thr Ser Met Tyr Trp Ser Ile Thr Thr Leu Thr Thr Val
 1   5   10   15

Gly Tyr Gly Asp Leu His Pro Val Asn Thr Lys Glu Met Ile Phe Asp
                20   25   30

Ile Phe Tyr Met Leu Phe Asn Leu Gly Leu Thr Ala Tyr Leu Ile Gly
             35   40   45

Asn Met Thr Asn Leu Val Val His Gly Thr
        50   55

<210> 35
<211> 58
<212> PRT
<213> Homo sapiens

<400> 35
Lys Tyr Val Thr Ala Leu Tyr Phe Thr Phe Ser Ser Leu Thr Ser Val
 1   5   10   15

Gly Phe Gly Asn Val Ser Pro Asn Thr Asn Ser Glu Lys Ile Phe Ser
            20   25   30

Ile Cys Val Met Leu Ile Gly Ser Leu Met Tyr Ala Ser Ile Phe Gly
        35   '   40   45

Asn Val Ser Ala Ile Ile Gln Arg Leu Tyr
    50   55

<210> 36
<211> 60
<212> PRT
<213> Rattus norvegicus

<400> 36
Gly Met Thr Ser Ala Phe Leu Phe Ser Leu Glu Thr Gln Val Thr Ile
 1   5   10   15

Gly Tyr Gly Phe Arg Phe Val Thr Glu Gln Cys Ala Thr Ala Ile Phe
            20   25   30

Leu Leu Ile Phe Gln Ser Ile Leu Gly Val Ile Ile Asn Ser Phe Met
        35   40   45

Cys Gly Ala Ile Leu Ala Lys Ile Ser Arg Pro Lys
    50   55   60

<210> 37
<211> 60
<212> PRT
<213> Homo sapiens

<400> 37
Gly Phe Val Ser Ala Phe Leu Phe Ser Ile Glu Thr Glu Thr Thr Ile
 1   5   10   15

Gly Tyr Gly Tyr Arg Val Ile Thr Asp Lys Cys Pro Glu Gly Ile Ile
            20   25   30

Leu Leu Leu Ile Gln Ser Val Leu Gly Ser Ile Val Asn Ala Phe Met
        35   40   45

Val Gly Cys Met Phe Val Lys Ile Ser Gln Pro Lys
    50   55   60

<210> 38
<211> 57
<212> PRT
<213> Homo sapiens

<400> 38
Glu Tyr Ile Tyr Cys Leu Tyr Trp Ser Thr Leu Thr Leu Thr Thr Ile
 1   5   10   15

Gly Glu Thr Pro Pro Pro Val Lys Asp Glu Glu Tyr Leu Phe Val Ile
            20   25   30

Phe Asp Phe Leu Ile Gly Val Leu Ile Phe Ala Thr Ile Val Gly Asn
     35   40   45

Val Gly Ser Met Ile Ser Asn Met Asn
    50   55

<210> 39
<211> 57
<212> PRT
<213> Homo sapiens

<400> 39
Lys Tyr Val Tyr Ser Leu Tyr Trp Ser Thr Leu Thr Leu Thr Thr Ile
  1   5   10   15

Gly Glu Thr Pro Pro Pro Val Arg Asp Ser Glu Tyr Val Phe Val Val
          20   25   30

Val Asp Phe Leu Ile Gly Val Leu Ile Phe Ala Thr Ile Val Gly Asn
     35   40   45

Ile Gly Ser Met Ile Ser Asn Met Asn
    50   55

<210> 40
<211> 4
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:selectivity
      filter sequence

<400> 40
Val Gly Tyr Gly
  1

<210> 41
<211> 36
<212> PRT
<213> Streptomyces lividans

<400> 41
Glu Arg Gly Ala Pro Gly Ala Gln Leu Ile Thr Tyr Pro Arg Ala Leu
  1   5   10   15

Trp Trp Ser Val Glu Thr Ala Thr Thr Val Gly Tyr Gly Asp Leu Tyr
          20   25   30

Pro Val Thr Leu
       35

<210> 42
<211> 36
<212> PRT
<213> Drosophila melanogaster

<400> 42

```
Glu Ala Gly Ser Glu Asn Ser Phe Phe Lys Ser Ile Pro Asp Ala Phe
 1               5                  10                  15

Trp Trp Ala Val Val Thr Met Thr Thr Val Gly Tyr Gly Asp Met Thr
             20              25                  30

Pro Val Gly Phe
         35
```